

PATENT COOPERATION TREATY

PCT

REC'D 27 DEC 2000

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

15

Applicant's or agent's file reference TP 1291 WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE99/01593	International filing date (day/month/year) 13.09.1999	Priority date (day/month/year) 15.09.1998
International Patent Classification (IPC) or national classification and IPC7 B 01 F 5/08		
Applicant Tetra Laval Holdings & Finance SA et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 14.04.2000	Date of completion of this report 14.12.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Wiva Asplund/ELY Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE99/01593

I. Basis of the report

1. With regard to the **elements** of the international application:*

- ☒ the international application as originally filed
- ☐ the description:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the claims:
 pages _____, as originally filed
 pages _____, as amended (together with any statement) under article 19
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the drawings:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
 pages _____, as originally filed
 pages _____, filed with the demand
 pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language english which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE99/01593

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>2-4</u>	YES
	Claims	<u>1</u>	NO
Inventive step (IS)	Claims		YES
	Claims	<u>2-4</u>	NO
Industrial applicability (IA)	Claims	<u>1-4</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Document cited in the International Search Report:
US 1496858 A

The claimed invention relates to a method for homogenization of a pressurised emulsion in liquid state, in which the liquid is caused to pass at least two concentrically placed homogenization gaps. The liquid from one gap meets the liquid from one or more of the other gaps at high speed in a restricted space.

The cited document discloses a method for homogenization of liquids, at which the liquid is caused to pass through a metal block provided with an inlet channel *a*, channels *c* and *d*, which first run radially and then axially, and narrow radial channels (gaps) *e* and *f*. These channels discharge in a restricted space *g*, in which the liquid from channel *e* meets the liquid from channel *f* at high speed. The channel *g* is connected to a second set of channels *c-f*, which is connected to an outlet channel *b*.

In view of the cited document the method according to claim 1 lacks novelty.

In claim 2 the expression "narrow surfaces" is unclear, c.f. PCT Preliminary Examination Guidelines, chapter III, 4.5.

To use gaps between a valve seat and a valve cone for homogenization of liquids according to claim 2 is considered obvious for a person skilled in the art. Also the method according to claims 3 and 4 is considered to be obvious. Thus, the claims 2-4 do not comprise an inventive step.

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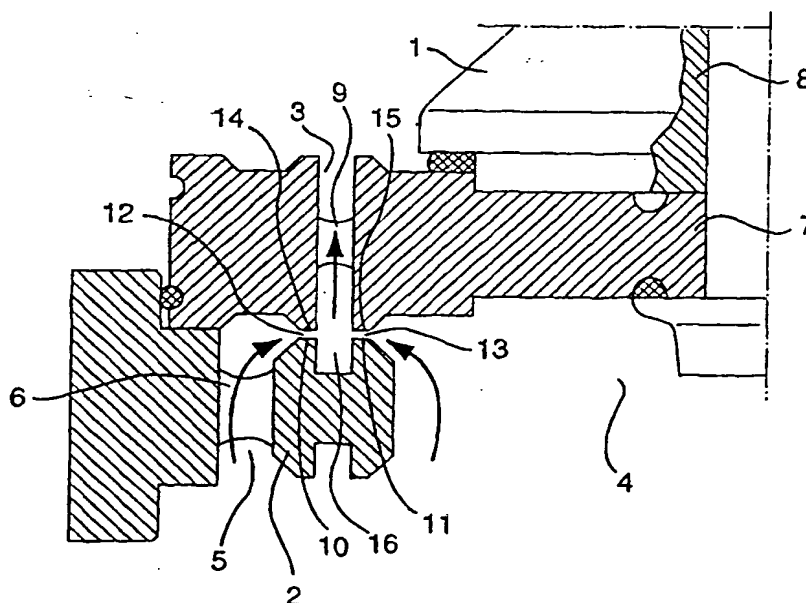
WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁷ : B01F 5/08</p>	<p>A1</p>	<p>(11) International Publication Number: WO 00/15327 (43) International Publication Date: 23 March 2000 (23.03.00)</p>
<p>(21) International Application Number: PCT/SE99/01593 (22) International Filing Date: 13 September 1999 (13.09.99) (30) Priority Data: 9803124-8 15 September 1998 (15.09.98) SE (71) Applicant (for all designated States except US): TETRA LAVAL HOLDINGS & FINANCE SA [CH/CH]; 70, avenue Général-Guisan, CH-1009 Pully (CH). (72) Inventors; and (75) Inventors/Applicants (for US only): INNINGS, Fredrik [SE/SE]; Slussvägen 12 I, S-211 30 Malmö (SE). MALMBERG, Rolf [SE/SE]; Spårsnövägen 44, S-226 52 Lund (SE). (74) Agent: BRUNNSTRÖM, Gunilla; AB Tetra Pak, Patent Dept., Ruben Rausing's gata, S-221 86 Lund (SE).</p>		<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>

(54) Title: A METHOD OF HOMOGENIZATION



(57) Abstract

The invention relates to a method of homogenization of a pressurised liqueform emulsion, such as milk. The liquid is caused to pass at least two concentrically placed homogenization gaps (12, 13) which are formed in the space between two narrow surfaces (10, 11) on a fixed valve seat (2) and two narrow surfaces (14, 15) on a movable valve cone (1). When the liquid passes the homogenization gaps (12, 13), a first homogenization takes place. The homogenization is rendered more efficient in that the liquid, when it passes out from one of the homogenization gaps (12) at high speed and in a restricted space, meets the liquid out from one or more of the other homogenization gaps (13).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
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BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
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CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

INTERNATIONAL SEARCH REPORT

International application No. —

PCT/SE 99/01593

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B01F 5/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI,EPODOC, PAJ, US FULLTEXT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1496858 A (RUDOLF KNOLLENBERG), 10 June 1924 (10.06.24), page 1, line 89 - page 2, line 10, figure 1 -----	1-4

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

7 December 1999

Date of mailing of the international search report

22 -01- 2000

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Wiva Asplund/MP
Telephone No. +46 8 782 25 00

Information on patent family members

International application No: —

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 1496858 A	10/06/24	NONE	

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference TP 1291 WO	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/SE 99/01593	International filing date (day/month/year) 13 Sept 1999	(Earliest) Priority Date (day/month/year) 15 Sept 1998
Applicant Tetra Laval Holdings & Finance SA et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (See Box I).
2. ☐ Unity of invention is lacking (See Box II).
3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
 - ☐ filed with the international application.
 - ☐ furnished by the applicant separately from the international application,
 - ☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
 - ☐ transcribed by this Authority.
4. With regard to the title, ☒ the text is approved as submitted by the applicant.
 - ☐ the text has been established by this Authority to read as follows:
5. With regard to the abstract,
 - ☒ the text is approved as submitted by the applicant.
 - ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. The figure of the drawings to be published with the abstract is:
 - Figure No. 2 ☐ as suggested by the applicant. ☐ None of the figures.
 - ☐ because the applicant failed to suggest a figure.
 - ☒ because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01593

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B01F 5/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI,EPODOC, PAJ, US FULLTEXT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1496858 A (RUDOLF KNOLLENBERG), 10 June 1924 (10.06.24), page 1, line 89 - page 2, line 10, figure 1 -----	1-4

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

7 December 1999

Date of mailing of the international search report

22-01-2000

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Wiva Asplund/MP
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/11/99

International application No.

PCT/SE 99/01593

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 1496858 A	10/06/24	NONE	

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ SE

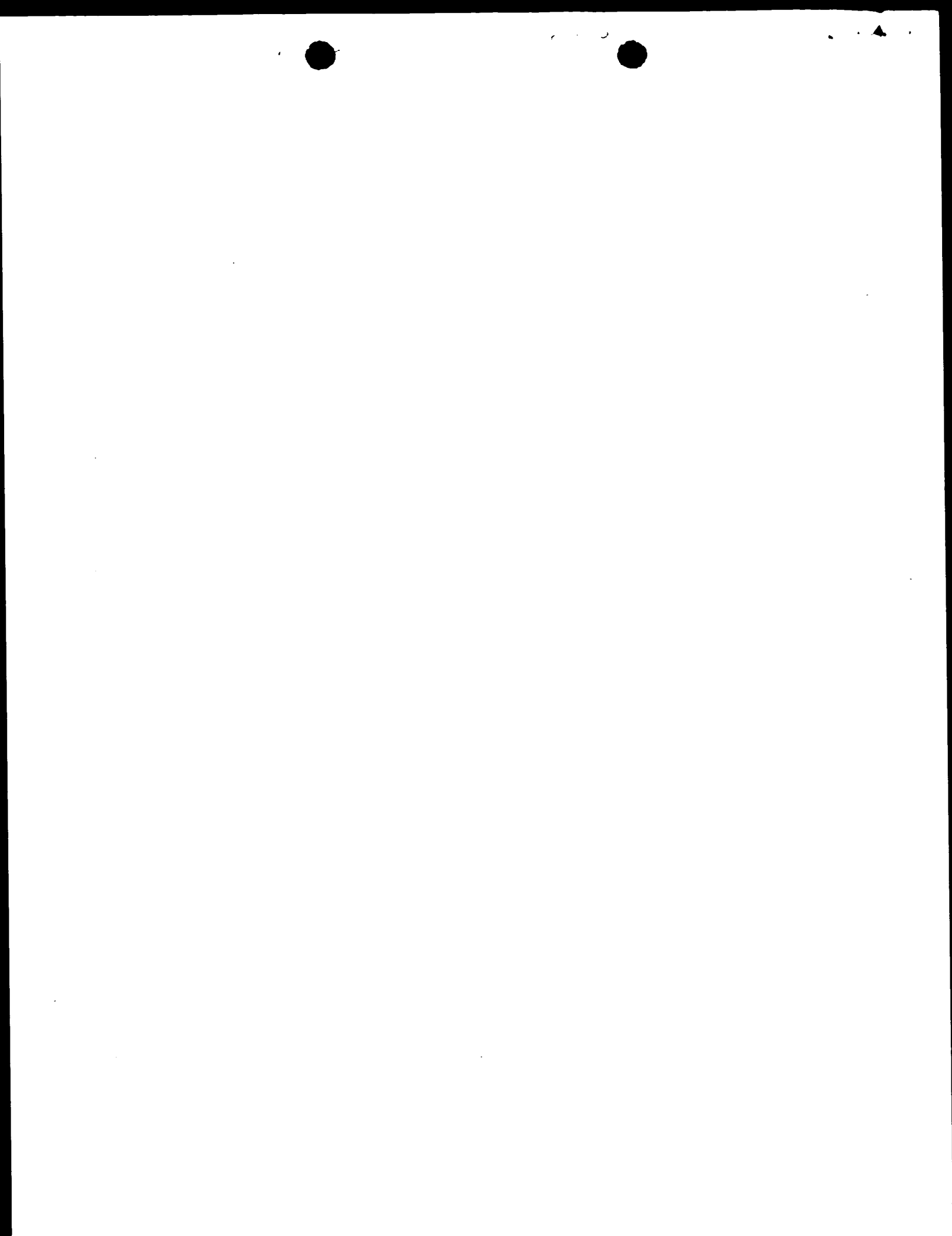
PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION	
Applicant's or agent's file reference TP 1291 WO	
International application No. PCT/SE99/01593	International filing date (day/month/year) 13.09.1999
(Earliest) Priority date (day/month/year) 15.09.1998	
Title of invention A method of homogenization	
Box No. II APPLICANT(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) Tetra Laval Holdings & Finance SA Avenue Général-Guisan 70 CH-1009 PULLY Switzerland	
Telephone No.: +41 21 7292211	
Facsimile No.: +41 21 7292759	
Teleprinter No.: 045 455811	
State (that is, country) of nationality: CH	State (that is, country) of residence: Switzerland
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) INNINGS, Fredrik Slussvägen 12 I S-211 30 MALMÖ Sweden	
State (that is, country) of nationality: SE	State (that is, country) of residence: Sweden
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) MALMBERG, Rolf Spårsnövägen 44 S-226 52 LUND Sweden	
State (that is, country) of nationality: SE	State (that is, country) of residence: Sweden
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.	



Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*BRUNNSTRÖM, Gunilla
AB Tetra Pak
Patent Department
Ruben Rausing's gata
S-221 86 LUND
Sweden

Telephone No.:

+46 46 362323

Facsimile No.:

+46 46 137923

Teleprinter No.:

32140 TPLUND S

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☐ as originally filed☐ as amended under Article 34the claims ☐ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☐ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English.....

☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary
Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (<i>specify</i>): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).


Gunilla Brunnström

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

CHAPTER II

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

<p>International application No. PCT/SE99/01593</p> <p>Applicant's or agent's file reference TP 1291 WO</p> <p>Applicant TETRA LAVAL HOLDINGS & FINANCE SA</p> <p>Calculation of prescribed fees</p> <p>1. Preliminary examination fee 4200,- P</p> <p>2. Handling fee <i>(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)</i> 1270,- H</p> <p>3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box.....</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto;"> 5470,- TOTAL </div> <p>Mode of Payment</p> <table style="width: 100%;"> <tr> <td><input checked="" type="checkbox"/> authorization to charge deposit account with the IPEA (see below)</td> <td><input type="checkbox"/> cash</td> </tr> <tr> <td><input type="checkbox"/> cheque</td> <td><input type="checkbox"/> revenue stamps</td> </tr> <tr> <td><input type="checkbox"/> postal money order</td> <td><input type="checkbox"/> coupons</td> </tr> <tr> <td><input type="checkbox"/> bank draft</td> <td><input type="checkbox"/> other (specify):</td> </tr> </table>	<input checked="" type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash	<input type="checkbox"/> cheque	<input type="checkbox"/> revenue stamps	<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons	<input type="checkbox"/> bank draft	<input type="checkbox"/> other (specify):	<p style="text-align: center;">For International Preliminary Examining Authority use only</p> <p style="text-align: center;">Date stamp of the IPEA</p>
<input checked="" type="checkbox"/> authorization to charge deposit account with the IPEA (see below)	<input type="checkbox"/> cash								
<input type="checkbox"/> cheque	<input type="checkbox"/> revenue stamps								
<input type="checkbox"/> postal money order	<input type="checkbox"/> coupons								
<input type="checkbox"/> bank draft	<input type="checkbox"/> other (specify):								

Deposit Account Authorization *(this mode of payment may not be available at all IPEAs)*

The IPEA/ SE ☒ is hereby authorized to charge the total fees indicated above to my deposit account.

☐ *(this check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)* is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

164020

Deposit Account Number

12.04.2000

Date (day/month/year)

Signature **Gunilla Brunström**



PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
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Date of mailing (day/month/year) 17 May 2000 (17.05.00)	
International application No. PCT/SE99/01593	Applicant's or agent's file reference TP 1291 WO
International filing date (day/month/year) 13 September 1999 (13.09.99)	Priority date (day/month/year) 15 September 1998 (15.09.98)
Applicant INNINGS, Fredrik et al	

1. The designated Office is hereby notified of its election made:

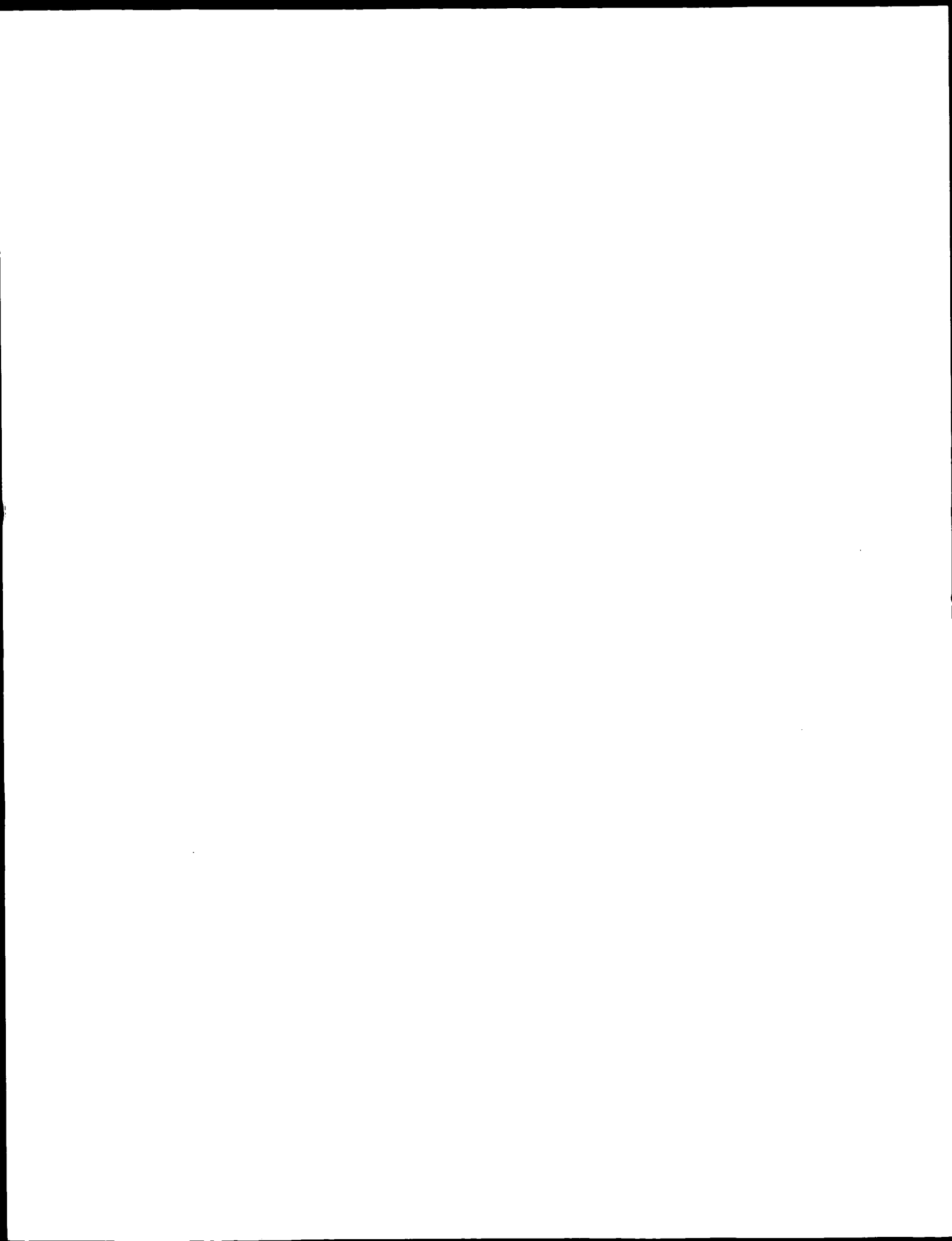
☒ in the demand filed with the International Preliminary Examining Authority on:
14 April 2000 (14.04.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

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09/787201
02 Rec'd PCT/PTO 15 MAR 2001

WO 00/15327

PCT/SE99/01593

A METHOD OF HOMOGENIZATION

TECHNICAL FIELD

5 The present invention relates to a method of homogenization of a pressurised liqueform emulsion, in which the liquid is caused to pass at least two concentrically placed homogenization gaps.

BACKGROUND ART

10 Homogenization is an industrial process which has long been employed and whose purpose is, in a fat emulsion such as, for example, milk, to shear or split the largest fat globules into smaller fat globules and by such means stabilise the fat emulsion. For, for example, milk, this implies that cream-clotting is prevented, and the vast majority of all consumer milk today is homogenized.

15 Homogenization normally takes place by mechanical processing, such that the fat emulsion, which is at a high infeed pressure, is forced at high speed to pass through a very narrow gap where the fat globules of the fat emulsion are broken up as a result of the turbulence which occurs at high speeds and by means of cavitation bubbles which implode in the liquid. The
20 process takes place during a very short period of time and what happens during this brief period is that the speed of the fat emulsion on its passage increases while the pressure drops, which results in the liquid coming to the boil.

25 A homogenizer substantially consists of a large piston pump which gives high pressure, and a counter-pressure device where the homogenization proper takes place. The counter-pressure device, the homogenizer valve in turn consists of a pressurised, resilient valve cone, a valve seat and a valve housing which surrounds the valve cone and the valve seat. The valve cone and the valve seat are normally rotation-
30 symmetric and are disposed such that between these parts, a radial throttle occurs which constitutes a homogenization gap. The height, width and length of the gap determine the volume at which the homogenization takes place. This volume must be as slight as possible in order to obtain an efficient homogenization. The gap height is reduced at an elevated pressure
35 on the liquid which is to be homogenized, at the same time as a greater flow entails that the gap height is increased.

It is often desirable today to employ a lower pressure on the liquid, at the same time as the intention is to increase the flow volume. This implies that a longer homogenization gap is needed. Various methods for lengthening the homogenization gap are known from the patent literature.

5 Swedish Patent Application SE 9701504-4 discloses a homogenization valve in which a number of homogenization gaps are concentrically disposed, which thereby gives an increased length of the homogenization gap.

Most generally, it is insufficient merely to extend the homogenization gap. In order to obtain as efficient homogenization as possible, where all fat globules, for example in milk, are sheared or split into such small fat globules that a stable emulsion is obtained. This problem has most generally been solved by carrying out the homogenization process in several stages.

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USPS 5,482,369 discloses a further method of obtaining an efficient homogenization. This method takes as its point of departure that the component parts or phases of the emulsion, for example water and fat which are both under pressure, are caused to pass through two opposed nozzles so that the two jets meet at high speed. The two nozzles are fixed and have a very narrow gap where the two liquids are to pass. Milk, which already from the outset consists of a mixed, unstable fat emulsion which may contain

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20 naturally occurring particles would, in such a homogenizer, rapidly block the narrow gaps of the nozzles and render the process unusable.

OBJECT OF THE INVENTION

One object of the present invention is to realise a homogenization gap which is of optimum design and is controllable for desired flow and pressure, at the same time as a more efficient and improved homogenization is obtained by utilising the speed at which the liquid passes the homogenization gap.

25

30 SOLUTION

This and other objects have been attained according to the present invention in that the method of homogenization of the type described by way of introduction has been given the characterizing feature that the liquid, when passing out from one of the homogenization gaps at high speed and in a restricted space, meets the liquid out from one or more of the other homogenization gaps.

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Preferred embodiments of the present invention have further been given the characterizing features as set forth in the appended subclaims.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

5 One preferred embodiment of the present invention will now be described in greater detail hereinbelow, with particular reference to the accompanying Drawings, in which:

Fig. 1 shows, partly in section, a conventional homogenization valve; and

10 Fig. 2 shows, partly in section, a part of a homogenization valve in which the method according to the present invention may be reduced into practice.

The Drawings show only those details and parts essential to an understanding of the present invention, and the placing of the
15 homogenization valve in the complete homogenizer, which is well-known to a person skilled in the art, has been omitted.

DESCRIPTION OF PREFERRED EMBODIMENT

A homogenization valve 20 of conventional type is shown in Fig. 1,
20 the homogenization valve 20 substantially consists of a valve housing 21 with an inlet 22 and an outlet 23 for the liquid which is to be homogenized, as well as a movable valve cone 1 and a fixed valve seat 2.

A part of a homogenization valve 20 of the type in which the method according to the present invention may be reduced into practice is shown in
25 Fig. 2. In the preferred embodiment, the valve seat 2 is rotation-symmetric and has a central throughflow channel 4 for the liquid which is to be homogenized. The through channel 4 constitutes an extension of the inlet 22 of the homogenization valve 20. From a central plane, the valve seat 2 is designed so that it is identical on both sides of the central plane and is, thus,
30 reversible in the valve housing 21, which implies a doubled service life for the valve seat 2.

In addition to the central throughflow channel 4, the valve seat 2 has a throughflow channel 5 for the liquid which is to be homogenized. Along its
35 extent, the throughflow channel 5 has a number of narrow connection bridges 6 which hold together the two concentric parts of the valve seat 2.

The valve cone 1, which is also rotation-symmetric, is pressurised, normally by a hydraulic or pneumatic piston 24, but may, in simpler versions, be pressurised by means of a grub screw which acts via a spring. The valve cone 1 is also movable, for example, via the oil in the cylinder, in order to absorb the rapid flow variations which occur in the liquid which is to be homogenized. This elasticity is necessary in order to handle the flow variations that naturally occur in piston pumps.

The valve cone 1 in the preferred embodiment is designed such that the lower region facing towards the valve seat 2 consists of a separate part 7, this part 7 being secured on a central part 8 of the valve cone 1. From a central plane, the part 7 is designed so that it is identical on both sides of the central plane and is, thus, reversible, which implies a doubled service life for the part 7 of the valve cone 1.

In the lower part 7 of the valve cone 1, there is provided a throughflow channel 3. Along its extent, the throughflow channel 3 has a number of narrow connection bridges 9 which hold together the two concentric parts of the part 7 of the valve cone 1.

On the valve seat 2, there are at least two narrow, planar surfaces 10 and 11 which each constitute one side of a homogenization gap 12, 13. Additional homogenization gaps 12, 13 may also occur pairwise and concentrically placed, but a homogenization valve 20 with more than four homogenization gaps 12, 13 would probably be difficult to manufacture.

On the valve cone 1, there are likewise two narrow, planar surfaces 14, 15 which each constitute the other side of the homogenization gaps 12 and 13. The surfaces 10, 11, 14, 15, respectively are placed in register and in spaced apart relationship to one another, this being designated gap height and is normally 50-200 μ m. The gap height may be varied with varied pressure and flow, in that the valve cone 1 is moved closer to or further away from the valve seat 2.

The distance between the two homogenization gaps 12 and 13 is the same as the width of the throughflow channel 3. The throughflow channel 3 may have a slight extension 16 provided in the valve seat 2. Alternatively, the valve cone 1 has a completely straight side which consists of the surfaces 10 and 11 and their extension. The surfaces 10, 14 and 11, 15, of the homogenization gaps 12 and 13, respectively should be completely straight

in order the better to guide the liquid through the homogenization gaps 12 and 13.

5 The liquid, normally milk, which is to be homogenized is led into the homogenizer and is there pressurised at approximately 10-25 Mpa. The milk normally has a fat content of 0.5-3.5 per cent and is at a temperature of 55-80°C.

10 The liquid is led in through the inlet of the homogenization valve 20 and when it reaches the valve seat 2 the liquid is distributed so that it partly passes through the central throughflow channel 4 and partly through the channel 5. Thereafter, the liquid passes through each respective homogenization gap 12 and 13 and a first homogenization takes place. In the passage, a very rapid pressure drop down to 0 Mpa is obtained, at the same time as the speed of liquid increases, which results in the liquid beginning to boil.

15 When the liquid from the two homogenization gaps 12 and 13 departs from the gaps 12 and 13, they will meet at high speed. This contributes to a large extent in improving the homogenization. Once the two flows have converged together, the speed reduces and the pressure once again increases. The liquid stops boiling and the steam bubbles in the liquid
20 implode. The entire process takes place during a few fractions of a second, and in the violent process where the high speed and converging of the two flows into one another give rise to turbulence and cavitation, the fat globules which are to be found in the liquid are sheared or split into smaller particles or globules.

25 The process takes place in a restricted space, i.e. between the outlets from the two homogenization gaps 12, 13 and partly in the throughflow channel 3, as well as possibly in its extension 16. Thereafter, the ready-homogenized liquid passes out through the throughflow channel 3 and departs from the homogenization valve 20 through its outlet 23.

30 Given that the gap height for the homogenization gaps 12, 13 may be varied, it is possible, on washing of the homogenization valve 20, to increase the distance between the valve cone 1 and the valve seat 2 and thereby obtain easily washed surfaces. Given that the valve seat 2 and the part 7 of the valve cone 1 have hygienic sealings against the valve housing 21 and the
35 part 8 of the valve cone 1, a hygienic homogenization valve 20 will be

obtained which satisfies the requirements of the food industry and which may be washed using conventional equipment.

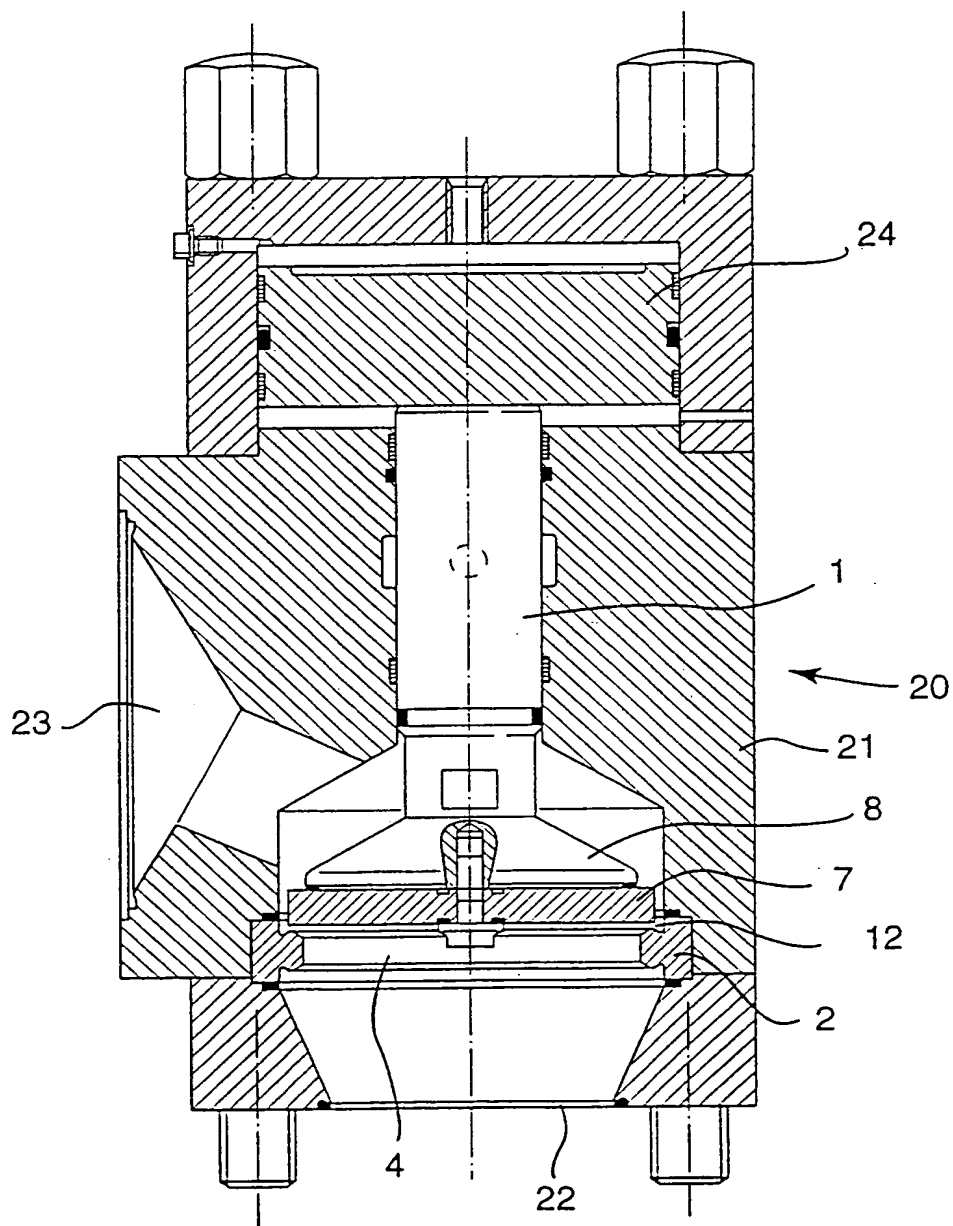
As will have been apparent from the foregoing description, a method of homogenization is realised which combines conventional homogenization
5 with counter-directed flows, which considerably improves the homogenization process. In that it is the homogenization gaps that create the counter-directed flows, problems which fixed nozzles entail are obviated in respect of the homogenization of milk.

The present invention should not be considered as restricted to that
10 described above and shown on the Drawings, many modifications being conceivable without departing from the scope of the appended Claims.

WHAT IS CLAIMED IS:

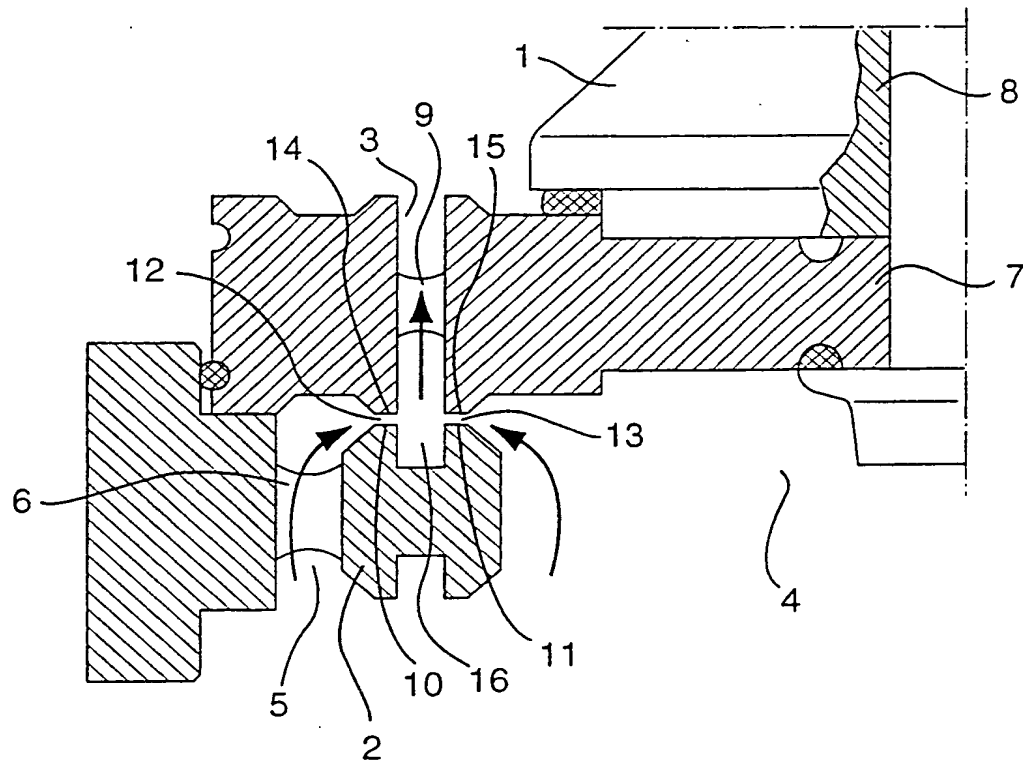
1. A method of homogenization of a pressurised liqueform emulsion, in which the liquid is caused to pass at least two concentrically placed homogenization gaps (12, 13), characterized in that the liquid, when passing out from one of the homogenization gaps (12) at high speed and in a restricted space, meets the liquid out from one or more of the other homogenization gaps (13).
2. The method as claimed in Claim 1, characterized in that the homogenization gaps (12, 13) are created in the space between two narrow surfaces (10, 11) on a valve seat (2), and two narrow surfaces (14, 15) on a valve cone (1).
3. The method as claimed in Claim 2, characterized in that the liquid is led into the homogenization gaps (12, 13) through a central throughflow channel (4) and a concentric throughflow channel (5) which are provided in the valve seat (2).
4. The method as claimed in Claim 2, characterized in that the liquid departs from the homogenization gaps (12, 13) via a throughflow channel (3) provided in the valve cone (1).

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*Fig 1*

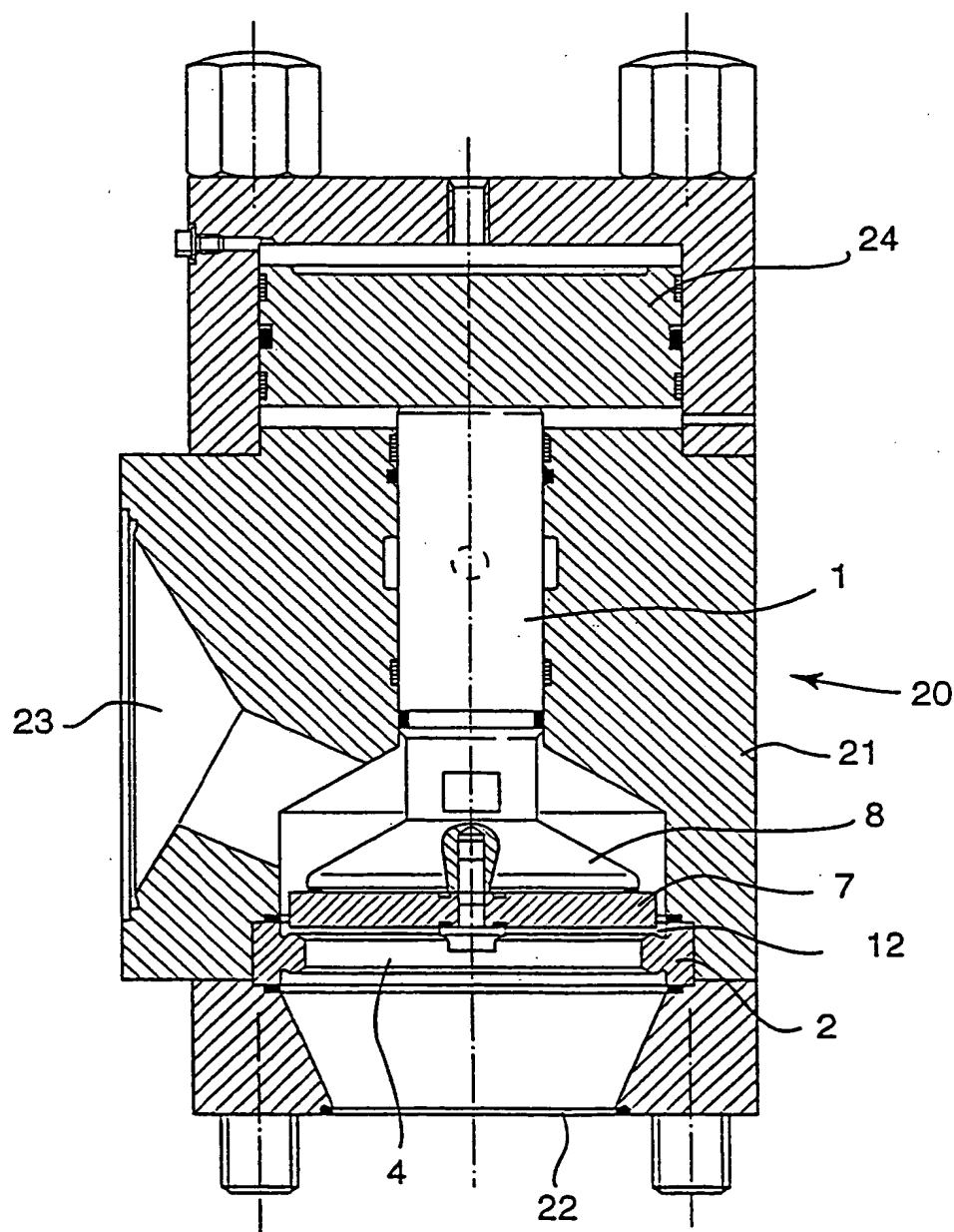
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*Fig 2*

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*Fig 1*

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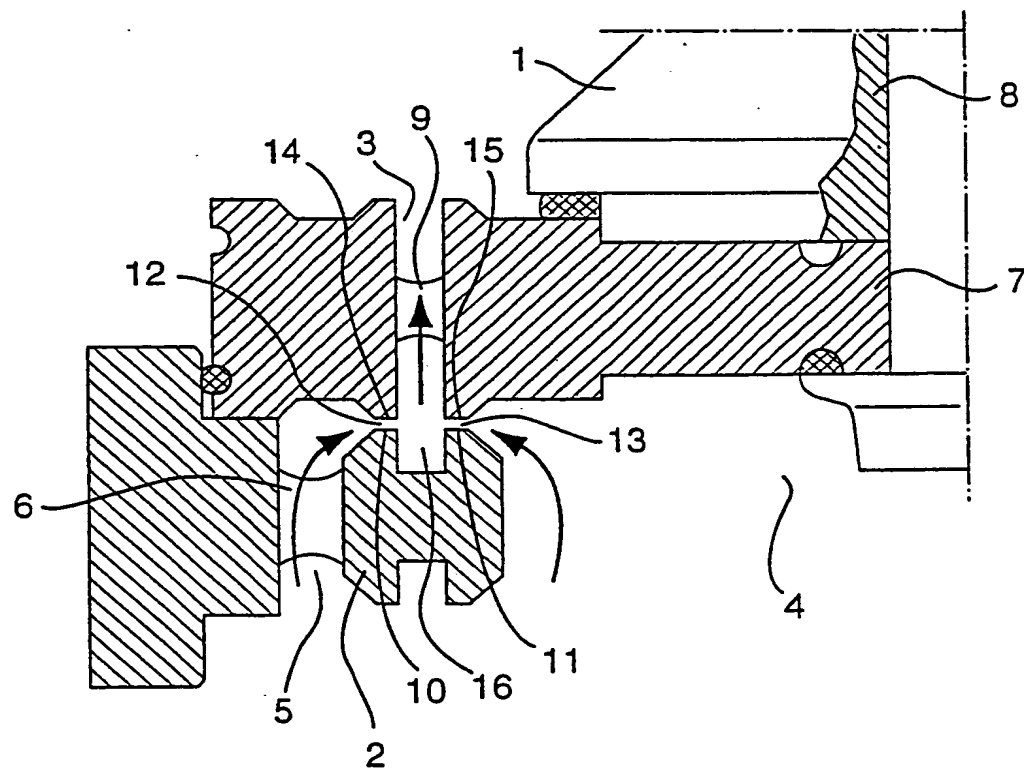


Fig 2

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